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No. 709,347

ISSUED May 11, 1965  
CLASS 96-1CANADA  
DIV. 176

## CANADIAN PATENT

PRODUCTION OF METALLIC DEVELOPERS FOR ELECTRO-  
PHOTOGRAPHY AND METALLIC INKS AND PAINTS

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Granted to Research Laboratories of Australia Limited, Adelaide,  
South Australia, AustraliaAPPLICATION No. 818,988  
FILED Mar. 14, 1961  
PRIORITY DATE Mar. 17, 1960 (58,525) Australia

No. OF CLAIMS 5

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This invention relates to the production of metallic developers for electrophotography and metallic inks and paints.

- Metallic inks and paints in the present state
5. of the art consist of suspensions of relatively fine metal powders in vehicles which serve the dual purpose of carrying the powders and binding them firmly to the surface which is printed or painted. The advantage of metallic inks were
  10. considered to be the attractive rich appearance given to printed matter. Early metallic inks were based on coarse metallic powders suspended in a vehicle of natural resins and waxes dissolved in linseed or chinawood oil to which Canada Balsam
  15. or Venice turpentine was frequently added to improve binding properties. The poor working properties of these inks led many printers to believe that all metallic inks were impractical. However, in recent years better metallic inks have
  20. been introduced which depend on the use of synthetic resins as the vehicle, such as modified phenolic resins. These newer vehicles were generally prepared by cooking the resin in a mixture of chinawood and linseed oils at low heat so that the
  25. resin is in a labile form and not in complete solution. Various waxes, driers and reducers are then added to produce a vehicle of the desired

due to the acidity of the vehicle, the action of the driers on the powder or to the presence of traces of sulphur in the vehicle.

- In mixing vehicle and bronze powder for printing
5. on good grades of coated one side label, litho, glazed and gum papers, an approximate mixture is five parts of vehicle to four parts of powder by weight.

- Aluminium powder in the form of a paste is made
10. by placing small pieces of sheet aluminium or small aluminium pellets, in a steel ball mill together with a solvent like varmolene and several percent of stearic acid and aluminium stearate. Grinding is continued until the product has reached the desired
15. degree of fineness and brilliance, whereupon it is removed from the mill and after a suitable ageing period is ready for use. In the preparation of ready-mixed aluminium inks, the paste aluminium is generally mixed with about equal parts by weight of
20. viscous metallic ink vehicle.

- It will be seen that there is a wide variety of metal powders available for printing. It is also well known that for other applications of metal powders such as for example in powder metallurgy the manufacture
25. of bearings from powdered metals, the coating of industrial objects with metal powders and also in cements, fairly coarse particles are desired such as

In one form of our invention the aim is to produce a metallic liquid developer. By the way of example, a zinc plate is cleaned and immersed in a hydrocarbon liquid of high electrical resistivity, say  $10^{10}$  ohm centimeter, and low dielectric constant, say 3.

Abrasive cutting paper is rubbed on the zinc plate beneath the surface of the liquid until a desired concentration of powder is set up in the liquid. It is found that this suspension is stable and not subject to flocculation and can be used as a developer to produce fine grained electro-photographic images.

In another form of our invention, the aim is to produce a metallic ink. The surface of a bronze, silver or aluminium block is subjected to a cutting action for example beneath the surface of a liquid such as trichlorotrifluoroethane, known under the Trade Mark Freon 113. This suspension when sufficiently concentrated is mixed with a resin varnish for printing ink purposes.

In another form of our invention the metal plate of copper, silver, gold platinum, zinc, steel or the like is subjected to a cutting action such as by the application of a diamond loaded dressing wheel, tip, or paper, under the surface of an inert liquid to which is added a resin which is soluble or partly soluble in the liquid. Such a combination of resin

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5. The ring 7 of the powder producing metal is fixed to a carrier 8 which is secured on the shaft 9 of a motor 10 fixed to the vessel 1 so that as the motor shaft 9 revolves, the carrier 8 is similarly revolved to carry the ring 7 with it.

10. The abrasive ring 6 is similarly attached to a carrier 12 mounted on the shaft 13 of a motor 14 which is supported on a floating frame 15 which in turn is coupled through springs 16 to the top 2, the top 2 having an opening 17 through it to allow the floating frame 15 free movement in relation to the top 2, the opening being however sealed against egress of liquid by a resilient diaphragm 18 disposed between the edge of the opening 17 and an outer face on the floating frame 15.

20. A labyrinth packing 19 prevents the outflow of liquid 5 between the boss 20 of the carrier 12 and the floating frame 15, while a labyrinth packing 22 prevents leakage of the liquid 5 from the vessel 1 between the boss 23 of the carrier 8 and the vessel 1.

25. The motor 10 and the motor 14 is so driven that the abrasive rings 6 rotate in the opposite direction to the ring 7 of the powder producing material so that there is a polishing action or cutting action between the contiguous surfaces of the abrasive ring and the powder producing ring, this surface however being disposed beneath the level of the liquid 5 in the vessel 1 to ensure that the polishing or grinding action on the powder producing ring 7 is

Attached to the vessel 30 is a ring 36 of abrasive material, the position of the ring 36 being such that the blocks 35 of the powder producing metal will be thrown outwardly by centrifugal force into contact with this ring, so that as the shaft 32 of the motor 31 is revolved, the carrier 33 will cause the boxes 34 which are secured thereon to move around and in turn causing the blocks 35 of the powder producing metal to rub against the abrasive ring to produce the metal powder, the action being again beneath the liquid 37 in the vessel 30.

Vanes 44 fixed in the vessel 30 limit rotation of the liquid 37 in the vessel 30, these being necessary to ensure that the liquid will be maintained in a turbulent condition where it will at all times be available at the inter-face between the blocks 35 and the grinding or abrasive ring 36.

A lid 38 is held down on to the vessel 30 by clips 39, packing means 40 being interposed between the lid 38 and a flange 41 on the vessel 30.

Leakage of liquid 37 between the boss 42 of the carrier 33 and the vessel 30 is prevented by a labyrinth packing 43.

From the foregoing it will be appreciated that the embodiment described with reference to Fig. 2 operates in a similar manner to the embodiment described with reference to Fig. 1, in that liquid 37 is contained in a vessel 30 and the powder is

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(2) Printing ink formulation

Solvent - White spirit

Metal - Aluminium, aluminium bronze, tin bronze

Grinding time at 3,000 revolutions per minute relative  
5. rotational speeds

Aluminium - 5 minutes

Aluminium bronze-12 minutes

Tin bronze - 10 minutes

Resins added as binders for printing ink.

10. For each gram of abraded metal add to solvent prior  
to grinding.

Resin Scopol 4IN 3 grms.

Stand Oil 3 grms.

(Scopol 4 IN is a long oil length vinyl toluene modified  
15. alkyd based on semi-drying/dehydrated castor oils

Vinyl toluene content 10%

Oil length 60%

Acid value 3 - 6

Sp. Gr. 20°C 1.050 + 0.005

20. Manufacturer Styrene Copolymers Ltd.

After grinding evaporate solvent to desired consistency  
for mechanical printing.



THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. The method of producing powdered metallic developers for electrophotography and metallic inks and paints which are characterized by the presence of micron-sized metal powders suspended in a carrier liquid which includes a binder consisting in subjecting a substantially smooth planar surface of a solid plate of the metal, which is to produce the powder for said developers, to the cutting action of an abrasive surface rubbed continuously thereagainst beneath an inert liquid which forms the final carrier and binder for the powder to produce developer or ink or paint with the powder of the desired ultimate micron size therein.
2. The method according to preceding claim 1 wherein the metal is pre-polished to have a smooth surface which is maintained during cutting.
3. For producing metallic developers for electrophotography and metallic inks and paints, apparatus comprising a vessel to contain liquid, a first carrier disposed in said vessel below the liquid level therein, a metal from which powder is to be produced carried by said carrier, a second carrier adjacent said first carrier also carried by said vessel to be disposed beneath the level of the liquid therein, an abrasive member on said second carrier, means to urge the said metal on to the said abrasive member, and means to rotate one said carrier whereby the said abrasive member has relative motion to the said metal to cut the face of the metal beneath the said liquid.

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